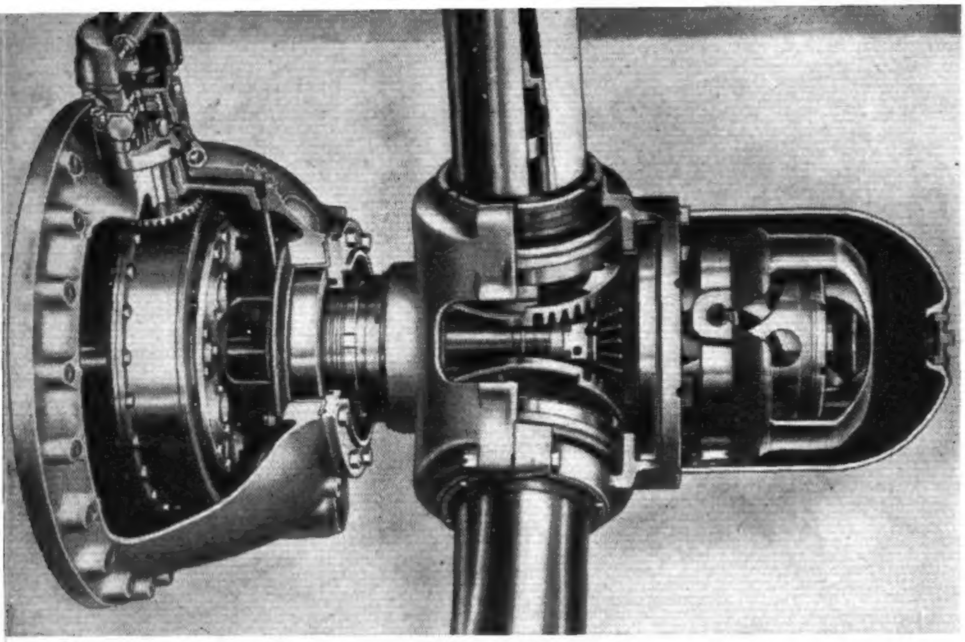

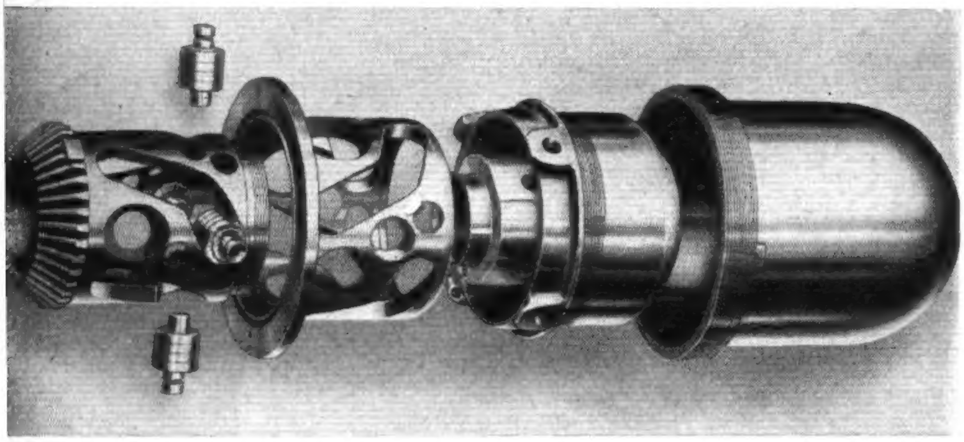

The photograph on the left shows the Hamilton Hydromatic in part section, while below it is an "exploded" view of the central assembly.

the system. Consequently it is necessary to provide some means of restricting the pitch range during normal operation so that the blades cannot be feathered except by a deliberate action on the part of the pilot. Accordingly, the designer took advantage of the fact that the centrifugal force acting on the blades tends to cause them to go into low pitch. In the Hydromatic design, engine oil which has been boosted to higher pressure by the constant-speed governor pump is used to overcome this centrifugal twisting moment when it is necessary to increase the pitch. This oil pressure acts on a large piston, the motion of which is transformed into rotary movement by means of a series of cam rollers acting on coaxial helical cams of opposite pitch slope. For the normal pitch range the cam follows a steep helical angle so that the piston enjoys a high mechanical advantage. When the pitch reaches the maximum operating value, the slope of the cam becomes flatter so that the mechanical advantage of the piston is insufficient to overcome the centrifugal twisting moments of the blades while normal operating pressures are used. Thus, a maximum pitch limit is provided for the normal flight conditions. If a considerably increased oil pressure is supplied from some other source under the control of the pilot, the piston will overcome the blade twisting moment and the pitch will increase until the feathered setting is reached.

The adjustment toward low pitch is also accomplished by oil pressure, supplementing and augmenting the centrifugal force on the blades. In this case the oil is also engine oil but under normal pressure. This oil pressure is at all times acting on the opposite face of the airscrew piston, and provides a "resilient member" opposing any tendency for a change to higher pitch. Whenever the constant-speed governor valve relieves the higher oil pressure on the other face of the piston, this resilient pressure, together with the centrifugal force on the blades, moves the blades toward low pitch.

To feather the blades an auxiliary pressure supply system is used. A typical example of such a system is shown in the drawing on the opening page of this article. The pump is mounted between the engine oil tank and the constant speed control, and delivers oil under pressure through the pipe-line marked "O" to the cut-out valve built into the base of the constant-speed control. The auxiliary system allows the pump to draw its oil from the engine oil tank; alternative installations have employed either a separate oil tank or have used the hydraulic system of the machine in place of engine oil and the special pump.

Turning now to the two diagrams on this page, we see that the pump rapidly builds up pressure in the pipe-line already referred to, disconnecting the governor from the airscrew and at the same time opening the pump line to the airscrew by compressing the spring P in the cut-off valve. This feathering oil pressure is transmitted to the rotating airscrew shaft past the oil transfer rings C through port E of the distributor valve assembly and out of port F to the inboard side of the piston H. The piston moves out under this pressure, forcing the engine oil on its outboard side in the dome G, through ports K and J into the oil supply pipe D and back into the lubricating system of the engine. As the piston moves out, the blades move to a higher pitch, the motion finally being stopped by the rotating cam coming up against an adjustable mechanical stop (not illustrated) set for the fully-feathered position of the particular blade concerned.

With all motion stopped and the feathering pump still functioning, the feathering oil pressure builds up until it reaches 400 lb./sq. in., at which point a pressure cut-out switch opens the electrical circuit operating the pump by de-energising the solenoid holding the cockpit solenoid switch in. With the blades feathered, engine rotation is stopped, and consequently the blade centrifugal twisting moment and engine-oil pressure have dropped to zero, and the blades remain in the feathered position. The entire feathering operation is accomplished in an average time of only 9 sec.

To "un-feather" the blade the pump is again started and permitted to build up a pressure greater than 400lb. per sq. in. by holding closed the cockpit solenoid switch. At about 500-600 lb. per sq. in. pressure the force at Q at the base of the distributor valve in the airscrew is great enough to force the valve out, compressing spring R, and the valve moves toward the position shown in the lower diagram, disconnecting the engine oil system from the dome. The oil from the pump starts to fill up the dome on the outboard side of the piston through ports S and K as the distributor valve moves out, and this oil starts pushing the piston in, unfeathering the blades. The oil on the inboard side of the piston is, of course, forced out through ports F and J into the engine oil system.

An unfeathered airscrew being moved through the air will start to windmill. When the engine reaches a reasonable r.p.m. the cockpit solenoid switch is released. The airscrew continues to windmill, cranking the engine, and it is thus possible to start the latter again. The moment the feathering pump stops, the spring in the cut-out valve in the governor

Studied in conjunction with the sequence-of-operations description on this page, the two drawings below make the method of operation obvious.